988. k. 22.
3

AN ESSAY
TOWARDS AN EXPLICATION
Of the PHÆNOMENA of *ELECTRICITY*,
Deduced from the ÆTHER of Sir *Iſaac Newton*,

Contained in THREE PAPERS which were read before
The ROYAL-SOCIETY.

By BENJAMIN WILSON.

K.

LONDON:
Printed for C. DAVIS, Printer to the Royal-Society,
againſt *Grays-Inn*, *Holbourn*, and M. COOPER,
in *Pater-noſter Row*. MDCCXLVI.

(Price One Shilling and Sixpence.)

Jos: Banks

T O

MARTIN FOLKES, Eſq;

PRESIDENT *of the* ROYAL-SOCIETY.

THIS ENDEAVOUR

To promote uſeful Knowledge,

Is inſcribed by his

Moſt obliged, and obedient

Humble ſervant,

BENJAMIN WILSON.

PREFACE.

[*] IN deriving the cauſes of things from their effects, it is the cuſtom of experimental philoſophers to frame no hypotheſes, nor receive them into philoſophy, otherwiſe than as queſtions whoſe truth may be diſputed. They are to derive the cauſes of all things from the moſt ſimple principles poſſible, but then they aſſume nothing as a principle that is not proved from experiments. It was this admirable way of philoſophizing, that enabled Sir Iſaac Newton, *to give us an explication of the ſyſtem of the world, moſt happily deduced from*

---

[*] Vid. Præf. *Coteſii* ad *Newt. Princip.* pag. 2.

the theory of gravity; and in like manner we hope to be able, from the phænomena of Electricity, to ſhew by experiments, how far it agrees with that moſt general of all material cauſes the æther: *the properties of which have been lately, and very learnedly treated by Dr.* Bryan Robinſon *of* Dublin.

In ſpeaking of electricity, bodies have hitherto been divided into two kinds: one ſort are term'd electrics per ſe; *the other non-electrics. The firſt have been ſuppoſed capable, upon friction, to emit a certain fluid called the electric matter, which can be communicated to bodies that are not electric, ſo as to cauſe certain effects; but only when ſuch non-electrics are placed or hung upon bodies that are electrics* per ſe; *and therefore it is, that non-electrics of themſelves, are ſaid to be incapable of emitting, or retaining the electric matter, when excited or communicated to them.*

How electrics per ſe, *ſuch as glaſs, wax, pitch, reſin, ſulphur, ſilk,* &c. *have thoſe peculiar properties; what this electric matter is; and how it acts upon bodies; is the ſubject of the following papers. They were laid before the Royal-Society in ſeveral parts; but not being ſo perfect as could be wiſhed, I have ſince made ſome alterations in them; and as the nature of the* æther *is not univerſally known, I have inſerted ſome quotations from Sir* Iſaac Newton, *to explain what his notions of it were; particularly an extract of his letter to Mr.* Boyle, *and likewiſe ſome propoſitions from a diſſertation on the* æther, *by Dr.* Bryan Robinſon; *by the peruſal of which, and the friendly aſſiſtance of the author, I have been enabled to bring theſe papers to the form in which they now appear. And I judged this neceſſary, becauſe the two laſt parts are more particularly intended to ſhew, that the* æther *and elec-*

tric matter are the ſame, or productive of the ſame effects.

If the contents of what follows, amount to a diſcovery of the cauſe of electricity; it was about the middle of June 1746 *I firſt obſerved it: by making an experiment, with two poliſhed planes of metal, placed very near, and parallel to each other, and afterwards electrifying one of them, by rubbing with my hand, the equatorial parts of a glaſs globe, thirteen inches diameter, as it turned on an iron axis placed horizontally, by means of a wheel ſixteen feet in circumference. The globe was fixed in an iron diſh, with cement at one end only, which diſh was made faſt to the axis, or ſpindle, like that of a common ſpinning wheel.* * *The conſequence*

---

* In *September* 1745 with the aſſiſtance of a friend in the country, I made ſome electrical experiments

ſequence of this experiment was, that ſeveral ſparks of light appeared to iſſue continually, from ſeveral places between the planes at the ſame time; and they ſeemed to come from the non-electrified plane, as well as the plane electrified. I was much ſurprized at the phænomenon, and, upon trying it ſeveral times, I was induced to make other experiments of the ſame nature; and from the ſucceſs of them, I framed an hypotheſis, which I confirmed every day more and more, to my own ſatisfaction. When I had gone ſo far, as to have matter enough to prove (as I imagined)

riments, with a globe fixed in a turner's lathe, much in the manner of this, which I had made in *March* following; but I had never ſeen, or ſo much as heard of any of the kind before (excepting the late Mr. Hawkeſbey's;) ſo that this machine on account of its largeneſs, is not ſo conveniently contrived, as ſome that I have ſeen lately made, by Mr. *George Adams*, mathematical inſtrument maker in *Fleet-ſtreet*, which are conciſe and ſimple, and very eaſy to be moved or carried any where.

what I had before conjectured, I wrote down my thoughts and ſettled them, as well as I was able; and ſhewed my papers to ſeveral ingenious and learned gentlemen. The purport of them was to ſhew, that the electric matter was in all bodies, in reciprocal proportion to their denſities, luminous, ſulphureous, and unctuous bodies only excepted: That it iſſued from all bodies, as well from thoſe that were not electrified, as from ſuch bodies as were electrified: Further, when any body was electrified, I called that quantity of electric matter, by which it was electrified, the exceſs of electric matter in that particular body, above its natural original quantity; from which, and an experiment of ſuſpending a light body between two planes, I endeavoured to account for the cauſe of gravity.

I remember that one of the gentlemen on peruſing my original papers, aſked, how

how this electric matter was collected, I anſwered, as it was very apparent from ſeveral experiments, that a luminous matter could be produced ad infinitum *from rubbing a glaſs globe, it was impoſſible that the electric matter ſhould iſſue from the* glaſs, *and to ſay how it was cauſed, I did not then pretend: but as the electric matter was accumulated, it was of no ſignification how, ſince I could prove, that it was in all bodies, as was mentioned in the papers I had ſhewn* *.

How well I was ſatisfied that the electric matter, did not iſſue from the glaſs, as Sir Iſaac Newton, *Mr.* Boyle *and others had ſuppoſed, will appear by a letter I wrote in September laſt from Cheſter*

---

* I have ſince found thoſe very original papers wherein is mentioned this particular circumſtance of my thinking, that the electric matter did not iſſue out of the glaſs, but from out of bodies that are called *non electrics.*

Cheſter (being apon a journey) to Mr. Ellicot *F. R. S. deſiring him to try the two following experiments, becauſe I could not there get a proper apparatus. One was to try if the electric matter came out of the glaſs or not, for I was greatly perſuaded from what I had done before, that the electric matter did not come from the glaſs, but the bodies contiguous. The other was a method from the experiment of the vial performed by profeſſor* Muſchenbroek, *to encreaſe the ſhock to any degree, which I had told Mr.* Ellicot, *before I left London, that I had great reaſon to believe, was in proportion to the points in contact of a non-electric on the out-ſide of the vial.*

Soon after I went over to Dublin where I had an opportunity of trying, with Dr. Robinſon, *the experiment I had deſired Mr.* Ellicot *to make, of rubbing a glaſs tube and ſtanding on wax, in order to find from whence the electric matter*

matter came: wherein I ſucceeded, and alſo in ſome other experiments which ſtill proved it to be in all bodies, and likewiſe as their quantities of matter inverſely: beſides the other experiment of the vial. I preſently after this wrote ſeveral letters to my friends in England with an account of my ſucceſs, and alſo one to the preſident of the ROYAL SOCIETY, *dated the* 2ᵈ *of Oct.* 1746, *which was read before the ſociety the* 23ᵈ *of the ſame month, wherein I mentioned that the experiments I had there made, ſtill* helped to illuſtrate *what I had advanced and ſhewn to ſeveral gentlemen before I left England, particularly* Martin Folkes *Eſq.* Samuel Mead *Eſq. Mr.* John Hyde *merchant in Charter-houſe Square, and Mr.* Watſon.

The experiment of a perſon, endeavouring to excite a body electric per ſe, *when he ſtands upon a body alſo electric* per ſe, *was made by Monſieur* Boſe *near two years ago, and other gentlemen have done it ſince, as I was informed on my return to England. But they not proceeding from any principle* a priori, *were not able to account for it; whereas it only helped to* illuſtrate *and* confirm *the principles I went upon; which I had ſhewn to the ſeveral gentlemen before mentioned: the ſame original papers I have ſtill by me, and ſhall produce them when deſired by any one, who may have the curioſity of ſeeing them.*

I have been the more particular in this relation, as the diſcovery (if it be one) is a matter of ſome moment: and tho' there may be different opinions concerning it, yet time and further enquiries, will perhaps reconcile all objections: and as the following ſheets were merely the production of ſome leiſure hours

hours from my buſineſs of portrait painting, I hope my readers, rather than find fault with any defects I may have been guilty of, will kindly ſupply them, with new endeavours of their own.

BOOKS Printed for C. DAVIS, againſt *Grays-Inn* in *Holborn*, Printer to the Royal-Society.

1. THeophraſtus's Hiſtory of Stones. With an *Engliſh* Verſion, and critical and philoſophical Notes, including the modern Hiſtory of the Gems, *&c.* deſcribed by that Author, and of many other of the native Foſſils. By *John Hill.* To which are added, two Letters, one to Dr. *James Parſons*, F. R. S. on the Colours of the *Sapphire* and *Turquoiſe.* And the other to *Martin Folkes*, Eſq; Doctor of Laws, and Preſident of the Royal-Society; upon the Effects of different Menſtruums on Copper. Both tending to illuſtrate the Doctrine of the Gems being coloured by metalline Particles.

2. An Eſſay towards a natural Hiſtory of the Earth and terreſtrial Bodies, eſpecially Minerals: As alſo of the Sea, Rivers, and Springs. With an Account of the univerſal Deluge: And of the Effects that it had upon the Earth. By JOHN WOODWARD, M. D. Profeſſor of Phyſick in *Greſham*-College, and Fellow of the Royal-Society.

3. Elements of the Art of aſſaying Metals. In two Parts. The firſt containing the Theory, the ſecond, the Practice of the ſaid Art. The Whole deduced from the true Properties and Nature of Foſſils; confirmed by the moſt accurate and unqueſtionable Experiments, explain'd in a natural Order, and with the utmoſt Clearneſs, By JOHN ANDREW CRAMER, M. D. To which is added, ſeveral Notes and Obſervations not in the Original, particularly uſeful to the *Engliſh* Reader. With an Appendix, containing a Liſt of the chief Authors that have been publiſh'd in *Engliſh* upon Minerals and Metals.

TO THE

ROYAL SOCIETY.

GENTLEMEN,

MANY and ſurpriſing are the experiments, that of late have been made, by ſeveral ingenious and learned gentlemen, in that part of experimental philoſophy, which treats of electricity; but as none of them (ſo far as I can learn) have been able to ſhew from what cauſe thoſe wonderful effects were produced, I was induced, from ſome experiments I have made, to attempt ſuch diſcovery; and to offer theſe my imperfect thoughts, for the cenſure, or approbation of your accurate and impartial judgements.

It is now five months, ſince I firſt begun the attempt, and within the laſt three months, I drew up a paper, but in a very inaccurate manner (yet as well as I was then capable) to explain my meaning: which was to ſhew, that the electric matter, iſſued from the non-electric, as well as bodies electrified; and that it was in *all bodies* in reciprocal proportion to their denſities; excepting, that unctuous and ſulphureous bodies, were more electric than others of the ſame denſity; and that when any body was electrified, I called the accumulated matter the exceſs of the original quantity of electric matter in that particular body. I ſhewed the paper to ſeveral of my friends, and to ſome gentlemen of your honourable Society, particularly the *Preſident* and Mr. *Watſon*. I have been ſince abroad, and have had the aſſiſtance of Dr. *Robinſon*, a very learned gentleman, to digeſt what I had wrote in a better and more intelligible manner, which is by Propoſitions, and proving them by Experiments. The whole is made as ſhort and conciſe as the ſubject would admit, becauſe I would not preſs too much on your time.

If, gentlemen, I ſhould be ſo fortunate, as to meet with your approbation of what I lay before you, I ſhall think myſelf happy and amply rewarded for the pains I have taken.

I am,

Gentlemen,

Your obedient,

and moſt devoted humble Servant,

London,
Oct. 23, 1746.

BENJAMIN WILSON.

A
DISSERTATION
ON
ELECTRICITY.

IT is agreed, that there are ſome bodies called electrics *per ſe*; wherein certain matter is excited by friction, by means of which light bodies are attracted and repelled; and that there are other bodies called non-electrics *per ſe*, to which this matter may be communicated ſo as to produce the ſame effects.

I believe, it is now likewiſe agreed, (ſince the publication of a late diſſertation on the *æther* of Sir *Iſaac Newton)* that the denſity of the *æther* in bodies, is greater, or leſs, in the reciprocal proportion of the denſities of the bodies; excepting that it is greater in ſulphureous, and unctuous bodies, than in other bodies of the ſame denſity.

So if there is electric matter in all bodies, it will be proved to be in thoſe bodies, in the ſame proportion: excepting, that the electric matter is alſo greater in ſulphureous and unctuous bodies, than in other bodies of the ſame denſity. This will appear in the courſe of the following propoſitions.

PROPOSITION I.

When two bodies are replete with electric matter, (whether they are originally ſo, or electrified) upon their approach to each other, no flame, ſnap, or ſenſation will iſſue, provided they be equally electric, or electrified.

Proof by EXPERIMENT.

Electrify two perſons equally, and

let them approach each other with a finger, and nothing will be ſeen to iſſue, ſo as to cauſe either flame, ſnap, or ſenſation.

Second Exp.

Let a bar of iron, which is electrified, be touched with a body electric *per ſe*, (as glaſs or wax) and the conſequence will be the ſame, as in the firſt experiment *.

Proposition II.

When two bodies are equally electrified, as in Propoſition the firſt, they will repel each other.

Proof by Experiment.

Let two feathers be tied in ſmall, but ſeparate flaxen threads, and hung cloſe to each other; then let them be electrified by the ſame power, and they will recede from one another.

---

* *N. B.* The ſecond experiment is not accurately true, for there will be a very ſmall ſpark or flame, but ſcarcely ſenſible, and therefore the conſideration of it is avoided.

PROPOSITION III.

A body electric *per ſe*, will prevent the electric matter from paſſing into the earth, from a perſon or other body electrified when placed upon it.

Proof by EXPERIMENT.

Let a perſon ſtand upon a body electric *per ſe*, and let him be electrified: he will be found to retain his electricity for ſome time.

COROLLARY.

Conſequently, bodies, electrics *per ſe*, will repel the electric matter.

PROPOSITION IV.

When any non-electric body is electrified, there will iſſue upon the approach of a non-electrified perſon, a flame, ſnap, and ſenſation: but this flame, &c. will decreaſe continually, on every near approach (provided ſuch perſon ſtands upon a body that is an original-electric) till by the repeated approaches, the electric matter in each ſhall be equal.

Proof by EXPERIMENT.

Let two perſons be placed on ſeparate electric bodies; and let one of them be electrified, with a given quantity of electric matter; then, if they approach each other, the ſnap and ſenſation at firſt will be ſtrong, the ſecond time weaker, the third ſtill leſs; and the oftener they come near, ſtill weaker the effect; till the electrified perſon communicates from himſelf, to the other, as much of the electric matter, as ſhall render them both equally electrified *.

---

* *N. B.* This experiment I had from Mr. *Watſon.*

COROLLARY.

Hence, the quantity, which electrified the firſt perſon, is conſiderably leſſened, by electrifying the latter equally with himſelf: and therefore ought to be in its effect more than half weaker, on account of the loſs, by the diſſipation in every exploſion; and this is confirmed by experiment: for if another non-electric touch either perſon, the ſenſation will be equal; and if the electrified perſons have a continual communication with each other, the effect will not be encreaſed, but it will be much more weak, than if the non-electric approached the firſt perſon which was electrified only. In the tryal of this experiment, let the intervals between the times of electrifying and touching, be as nearly equal as poſſible.

PROPOSITION V.

If bodies not abounding with luminous, ſulphureous and unctuous particles, are replete with electricity, the flame, ſenſation and ſnap, produced upon the approach of bodies not electrified, will be found greater or leſs acccording to their denſities.

Proof by EXPERIMENT.

Let there be three bodies of a given magnitude, but different denſity; one of wood, another of ſtone, and the third of iron: and let them be electrified, and a perſon approach towards each of them, with bodies of the ſame kind (not electrified) ſeparately: the ſenſation, flame, and ſnap, will be greateſt, from the denſeſt bodies; weaker, from the leſs denſe; and exceedingly weak, from the bodies that are leaſt denſe. Again, let the denſeſt body touch the rareſt, and the effect will be ſtronger, than when the rareſt bodies, and weaker than when the denſeſt bodies, approach each other.

PROPOSITION IV.

A body electric *per ſe*, interpoſed between a perſon and the earthwill prevent his exciting electricity in a another body by friction, ſo as to produce any conſiderable effect: and for the ſame reaſon, that ſuch electric bodies prevent the electrified matter from paſſing into the earth when he is electrified. See Prop. 3.

Proof by EXPERIMENT.

Let a man ſtand on a cake of bees wax, or on a board placed upon dry bottles; and let him have a tube of glaſs properly prepared, for exciting the electric matter; if then he rubs the ſame, it will be impoſſible to electrify a rod of iron, or any other body near him, that is properly fixt, or ſuſpended, ſo as to attract, and repel, with any great ſtrength: but if the perſon, who excites the tube, ſteps upon the *earth* and rubs it again, that inſtant the effect is greatly encreaſed.

LEMMA.

If A. B. (in fig. 1.) repreſent a non-electric ſolid, of an uniform denſity; and there be an elaſtic fluid in that body, in a quieſcent ſtate; and for the more eaſy conception, the ſame fluid be ſuppoſed uniformly denſe in that body, and any three particles of it be denoted by y, x, and t: then if the end or ſurface of any part of A B be rubbed, for example B, ſo that there be cauſed a rarefaction of the parts, and conſequently a vibrating motion of the *æther*, in that part of the ſurface B, by the friction of an elaſtic, and electric poliſhed body as glaſs (which repels electric matter by Corollary to Propoſition the fourth) the vibrative motion of the *æther* in A B, *for the ſame reaſon that it emits the particles of light*, will throw off the elaſtic particle t, upon the body originally replete with this electric matter, *viz.* the glaſs; and from thence will be repelled, or emitted with a greater force, and afterwards paſs into the denſeſt body, that happens to be neareſt, according to the properties of the *æther*; and when nothing is near it but the air, it diſſipates there: into the place of t, would move forward the particle x, that was next in the rarefied body A B, and there be emitted, by the vibrations of the *æther*, in like manner as t; and y being the next, it will alſo move forward with a like force into the place of x: and ſo on continually, when there is no interpoſition that may hinder this ſucceſſive motion. See Dr. *Robinſon*'s Diſſertation.

PROPOSTION VII.

If there is originally, a certain quantity of electric matter, in any particular body of a given magnitude, and denſity; and that quantity of electric matter be equally diſtributed by its uniform elaſtic force, according to the denſity of the parts, in that particular body; it will follow, that upon encreaſing the quantity of matter, by adding other bodies of the ſame kind, the quantity of electric matter will be encreaſed in the ſame proportion.

Proof by EXPERIMENT.

Let a tube of glaſs be rubbed by a perſon ſtanding upon an electric body (as in the experiment of Prop. the ſixth) the rod, as is there mentioned, will be electrified, as well as himſelf, in a ſmall proportion; and leſs, if he ſtands ſome diſtance from the rod, and has no communication with other non-electrics: but if he approaches near the rod, and another perſon, ſtanding alſo on wax, holds the rod with his hand, by which the quantity of contiguous matter is encreaſed, the quantity

tity of electric matter is encreaſed alſo; for there will be a ſtronger ſenſation than in the firſt caſe: and if two, three, four, or more perſons, ſtand upon wax, and touch the rod continually during the experiment, the effect will encreaſe, as the quantities of two, three, or four are added: and this encreaſe continues, by ſtill adding other quantities, till the perſon rubbing the tube is replete with an exceſs of the electric matter, which is continually going off, as we ſhall prove hereafter, and therefore not capable of receiving a greater quantity: inſtead of perſons, let the bodies added be of metal or other matter, the effect will be the ſame, regard being always had to the difference of denſity in ſuch bodies, and the luminous, ſulphureous and unctuous matter they originally contain, which make them more or leſs naturally electric: therefore the electric matter is in all bodies, and in the proporportion mentioned in this Propoſition: which was to be proved.

PROPOSITION VIII.

As it has been ſhewn that electrified bodies act upon light bodies, which are not electrified, ſo bodies not electrified are found to act upon the electric matter contained in bodies replete with electricity.

Proof by EXPERIMENT.

Let a wire be electrified in the dark, and let any non-electric be held at ſeven or eight inches diſtance from the end thereof; and there will be ſeen to iſſue from the wire, a continual ſtream of luminous matter, which will diverge to the non-electric: the divergency will leſſen by degrees till they become parallel, by approaching nearer with the non-electric. Again, if the non-electric be held, not directly before the end of the wire, but wide and diſtant about two inches from the end, the iſſuing matter will deſcribe curvilinear rays towards ſuch non-electric.

COROLLARY I.

Hence it appears, that bodies which are called non-electrics, act in like manner as thoſe that are electrified: the difference being only, that the acting force of one, is greater than the other which is given it by friction.

PROPOSITION IX.

Though bodies are capable of receiving an exceſs above their original quantities of this electric matter, that exceſs will diſſipate; but will iſſue more ſtrongly from the ends of bodies electrified, than any part elſe; and in paſſing off it will be ſeen to repel or attract light particles of matter, by putting them in motion.

Proof by EXPERIMENT.

The ſmoak of a candle held near the end of a wire electrified, will be driven away.

Second EXPERIMENT.

The ſame ſmoak, held near the middle of the wire, will be attracted and carried along the wire by the current of the iſſuing electric matter to the remote end.

For the iſſuing force is leſs on the ſurface, than at the ends of bodies electrified; and therefore the electric matter will act upon the ſmoak from the ſurface of the wire, in like manner as it does upon other bodies, which are larger in bulk and weight: But the particles of ſmoak being ſo ſmall, they cannot have or receive a quantity of this electric matter, ſufficient to acquire an atmoſphere round each particle, like denſer bodies, that are capable of being made replete with this electric fluid, which is elaſtic; and by the force of which elaſticity, bodies are repelled: as will be proved by the following Propoſition and Experiment.

PROPOSITION X.

When two equally electric atmoſpheres are brought ſo near as to touch, they will repell each other, (by Prop. II.) and that force by which the bodies are moved, will be equal in both, if the denſities are equal.

Proof by EXPERIMENT.

Tye a feather to a ſmall thread, and hang it to a wire electrified; then tye another to a thread of ſilk (which is not electrified) hold the feather by the ſilken thread, near the other which is electrified, the feather tyed to the ſilk, will be preſently replete alſo with the electric matter; then throw it, with all the force ſo light a body is

capable

capable of being thrown againſt the other feather, and you will ſee it will be impoſſible under thoſe circumſtances to make them touch one another; but on the contrary, they will rebound from each other at a conſiderable diſtance, in like manner as elaſtic bodies from a blown bladder when thrown againſt it.

PROPOSITION XI.

The electric matter is always endeavouring to paſs into the largeſt bodies when accumulated, till it is equally diſtributed every where, and as in the experiment of the feathers, an elaſtic atmoſphere ſurrounds them, ſo it may be conceived to ſurround all other bodies; and therefore the greater any body is, to which a given quantity is communicated, the leaſt ſenſible will be the effect.

For if A and B (in fig. 2.) denote two bodies of different magnitudes and denſities, and their diameters be in the ratio of 1 to 3, the electric matter originally in them, may be conceived to cauſe an atmoſphere round each, for the ſame reaſon, that there are round two feathers electrified, but in ſo ſmall a proportion that they act only at very near diſtances. Now if a greater and given quantity of the ſame electric matter can be put into A, the atmoſphere round it will be encreaſed to E, it is plain, that if the ſame, or an equal quantity paſſes into B, which is three times greater, the acting force will be twenty ſeven times leſs with reſpect to that quantity only, which was communicated to A and B (ſee Corollary to Prop. IV.) conſequently the atmoſphere round B will only be encreaſed in proportion to the quantity of electric matter accumulated. Therefore B to have an atmoſphere and acting force equal to A, ought to receive twenty ſeven times more electric matter.

COROLLARY.

Hence, we ſee the reaſon why the given quantity of electric matter diſſipates, or is attracted into the Earth, and on account of its vaſt diſproportion, the electric matter is never felt, as when accumulated, or communicated into ſmaller bodies.

PROPOSITION XII.

If a fluid of an uniform denſity ſurround a globe, and that be electrified and turn'd round on an axis, paſſing through its center, and there be held a non-electric near the equator of that body, the fluid will riſe ſucceſſively towards the non-electric, as it turns round, in *like manner as the ſea is affected by the moon:* And the more rare this medium is, which ſurrounds the globe, the greater will be its riſing or approach towards the non-electric.

Proof by EXPERIMENT.

Let a pumice ſtone, or other body which will imbibe water and can be made round and even on its ſurface, be perforated with a wire through the center for the poles, by which it is to be turn'd, and dipt into water after it has been poliſhed; then let a non-electric be held near the ball which is electrified, and the electrified ball turn'd gently round by its axis; the water on the ſurface ſo electrified will be ſeen to riſe, and always towards the non-electric, ſo that the diameter at the equatorial parts will be greater than at the poles, provided the non-electric is held nearer the equator than any other part.

This laſt Propoſition and Experiment, will be conſidered further at another opportunity, as there is ſomething in it very ſingular.

THE ELECTRIC matter when put into motion, moves with an exceeding great velocity; and when that motion is check'd by the near approach of another body, which leſſens the divergency of the iſſuing electric matter, the particles, as having light in their compoſition, and the vaſt velocity wherewith they move, will upon ſuch approach, and leſſen'd divergency, cauſe a ſudden rarefaction in the air, that will be attended with an exploſion, ſo as to produce the ſnap we hear; which electric matter diſſipates in flame: and it is that ſudden rarefaction which cauſes an almoſt inſtantaneous reſiſtance to the contiguous electric matter (as is proved by Lem. and Prop. VII.) which produces ſo ſurpriſing a ſenſation; and equal in the electric and non-electric bodies.

This reſiſtance and ſenſation can be encreaſed to any given degree, which I found by encreaſing the magnitude of the vial in profeſſor *Muſchenbroek*'s experiment, the thinneſs of the glaſs, and the touching ſurface or points in contact of a non-electric on the outſide. And for this purpoſe, I made uſe of water, wherein I immerged the vial, and electrified the water within as uſual.

I found alſo, that any particular member of the human body may be convulſed, without affecting any of the other members ſenſibly.

THIS ELECTRIC MATTER ſeems to be compoſed of *æther*, light, and other particles of matter that are of a ſulphurous nature.

As to the firſt, the Law of the *æther* is, that it is always denſer in rarer bodies, and in denſer bodies rarer: if this be true, then it is in all bodies, and therefore perhaps the chief conſtituent.

That there is light in the electric matter, appears from its ſuffering the ſame laws with the ſolar light, in being refracted through a priſm of glaſs.

*That ſulphur, or ſomething of that nature is part, tho' it maynot be eſſential, will be admitted from the ſmell we perceive from a finger, that has been held near to a rod electrified. Hence, the finger ſeems to be a ſtrainer, which filtrates the electric matter from the groſſer parts of the ſulphur or other matter emitted by the ſtrong vibrations of the *æther*. And when a globe, or tube of glaſs is made too warm, the electric matter in that caſe cannot be excited; the reaſon ſeems to be owing to the pores being more opened, and the vibrating motion of the *æther* greatly encreaſed by the bodies waxing more warm, which may throw off ſtill groſſer particles of ſulphur or other matter, whereby they prevent the ſubtile electric matter or *æther* paſſing ſo freely: and this ſeems really to be the caſe, for when the glaſs is made warm by friction, it ſmells more ſtrongly than when it is not ſo.

---

* See the beginning of the firſt letter to *Martin Folkes*, Eſq;

From the principles before mentioned, and the nature of an elaſtic fluid, it will be eaſy to reconcile the cauſe of all other electrical experiments, whether they be made by the vial, or otherwiſe. And alſo that uncommon experiment I made of ſuſpending leaf gold, ſo as to touch nothing viſibly, by means of two planes placed parallel to each other, at five or ſix inches diſtance, the one electrified, the other with this remarkable circumſtance, that if the planes are inverted, or placed vertical, the leaf gold between them will be always neareſt the non-electric, provided the flux of electric matter is always equal. Beſides another experiment made when the room is darkened, and that is the diverging light iſſuing from the non-electric, upon the globe of glaſs when electrizing.

General SCHOLIUM.

This electric or ſubtile matter, which is in all bodies more or leſs, and cauſes ſuch various and ſurpriſing phænomena, ſeems to be the great *Deſideratum* to account for many of the wonderful opperations in nature, particularly muſcular motion, and an univerſal attraction and gravity.

**Read the ſixth
of *Nov.* 1746.**

Extract of the letter from Sir ISAAC NEWTON, *to Mr.* BOYLE, *concerning the* Æther.

Written in the year 1678.

FIRST, I ſuppoſe, that there is diffuſed through all places an ætherial ſubſtance, capable of contraction and dilation, ſtrongly elaſtic, and, in a word, much like air in all reſpects, but far more ſubtile.

2. I ſuppoſe this æther pervades all groſs bodies, but yet ſo as to ſtand rarer

in their pores than in free ſpaces, and ſo much the rarer as their pores are leſs. And this I ſuppoſe (with others) to be the cauſe, why light incident on thoſe bodies is refracted towards the perpendicular; why two well poliſh'd metals cohere in a receiver exhauſted of air; why mercury ſtands ſometimes up to the top of a glaſs pipe, though much higher than 30 inches; and one of the main cauſes, why the parts of all bodies cohere; alſo the cauſe of filtration, and of the riſing of water in ſmall glaſs pipes above the ſurface of the ſtagnating water they are dipped into: for I ſuſpect the æther may ſtand rarer, not only in the inſenſible pores of bodies, but even in the very ſenſible cavities of thoſe pipes. And the ſame principle may cauſe menſtruums to pervade with violence the pores of the bodies they diſſolve, the ſurrounding æther, as well as the atmoſphere, preſſing them together.

3. I ſup-

3. I ſuppoſe the rarer æther within bodies, and the denſer without them, not to be terminated in a mathematical ſuperficies, but to grow gradually into one another; the external æther beginning to grow rarer, and the internal to grow denſer, at ſome little diſtance from the ſuperficies of the body, and running through all intermediate degrees of denſity in the intermedite ſpaces: And this may be the cauſe, why light, in *Grimaldo*'s experiment, paſſing by the edge of a knife, or other opake body, is turned aſide, and as it were refracted, and by that refraction makes ſeveral colours. Let A B C D (Fig. 5.) be a denſe body, whether opake, or tranſparent, E F G H the outſide of the uniform æther, which is within it, I K L M the inſide of the uniform æther, which is without it; and conceive the æther, which is between E F G H and I K L M, to run through all intermediate degrees of

denſity between that of the two uniform æthers on either ſides. This being ſuppoſed, the rays of the ſun S B, S K, which paſs by the edge of this body, between B and K, ought in their paſſage through the unequally denſe *æther* there, to receive a ply from the denſer æther, which is on that ſide towards K, and that the more, by how much they paſs nearer to the body, and thereby to be ſcattered through the ſpace P Q R S T, as by experience they are found to be. Now the ſpace between the limits E F G H and I K L M, I ſhall call the ſpace of the æther's graduated rarity.

4. When two bodies moving towards one another come near together, I ſuppoſe the æther between them to grow rarer than before, and the ſpaces of its graduated rarity to extend further from the ſuperficies of the bodies towards one another; and this, by reaſon, that the æther cannot move and

play up and down ſo freely in the ſtraight paſſage between the bodies, as it could before they came ſo near together. Thus, if the ſpace of the æther's graduated rarity reach from the body A B C D E F (Fig. 6.) only to the diſtance G H L M R S, when no other body is near it, yet may it reach farther, as to I K, when another body N O P Q approaches: and as the body approaches more and more, I ſuppoſe the æther between them will grow rarer and rarer.

Theſe ſuppoſitions I have ſo deſcribed, as if I thought the ſpaces of graduated *æther* had preciſe limits, as is expreſſed at I K L M in the firſt figure, and G M R S in the ſecond: for thus I thought I could better expreſs my ſelf. But really I do not think they have ſuch preciſe limits, but rather decay inſenſibly, and, in ſo decaying, extend to a much greater diſtance, than can eaſily be believed, or need be ſuppoſed.

5. Now from the fourth ſuppoſition it follows, that when two bodies, approaching one another, come ſo near together, as to make the *æther* between them begin to rarefy, they will begin to have a reluctance from being brought nearer together, and an endeavour to recede from one another: which reluctance and endeavour will encreaſe, as they come nearer together, becauſe thereby they cauſe the interjacent æther to rarefy more and more. But at length, when they come ſo near together, that the exceſs of preſſure of the external æther, which ſurrounds the bodies, above that of the rarefied æther, which is between them, is ſo great, as to overcome the reluctance, which the bodies have from being brought together; then will that exceſs of preſſure drive them with violence together, and make them adhere ſtrongly to one another, as was ſaid in the ſecond ſuppoſition. For

inſtance, in the ſixth figure, when the bodies ED and NP are ſo near together, that the ſpaces of the æther's graduated rarity begin to reach to one another, and meet in the line IK; the æther between them will have ſuffered much rarefaction, which rarefaction requires much force, that is, much preſſing of the bodies together: and the endeavour, which the æther between them has to return to its former natural ſtate of condenſation, will cauſe the bodies to have an endeavour of receding from one another. But on the other hand, to counterpoiſe this endeavour, there will not yet be any exceſs of denſity of the æther, which ſurrounds the bodies, above that of the æther, which is between them at the line IK. But if the bodies come nearer together, ſo as to make the æther in the mid-way line IK grow rarer than the ſurrounding æther, there will ariſe from the exceſs of denſity of the ſurrounding æther a compreſſure of the bodies towards one another: which when by the nearer approach of the bodies it becomes ſo great, as to overcome the aforeſaid endeavour the bodies have to recede from one another, they will then go towards one another, and adhere together. And, on the contrary, if any power force them aſunder to that diſtance, where the endeavour to recede begins to overcome the endeavour to accede, they will again leap from one another. Now hence I conceive it is chiefly, that a fly walks on water without wetting her feet, and conſequently without touching the water; that two poliſhed pieces of glaſs are not without preſſure brought to contact, no, not though the one be plain, the other a little convex; that the particles of duſt cannot by preſſing be made to cohere, as they would do, if they did but fully touch; that the particles of tinging ſubſtances and ſalts diſſolved in water do not of their own accord concrete and fall to the bottom, but diffuſe themſelves all over the liquor, and expand ſtill more, if you add more liquor to them. Alſo, that the particles of vapours, exhalations, and air, do ſtand at a diſtance from one another, and endeavour to recede as far from one another, as the preſſure of the incumbent atmoſphere will let them: for I conceive the confuſed maſs of vapours, air, and exhalations, which we call the atmoſphere, to be nothing elſe but the particles of all ſorts of bodies, of which the earth conſiſts, ſeparated from one another, and kept at a diſtance, by the ſaid principle.

There is one conjecture more about the cauſe of gravity. I ſuppoſe the *æther* to conſiſt of parts differing from one another in ſubtilty by indefinite degrees: that in the pores of bodies there is leſs of the groſſer æther, in proportion to the finer, than in open ſpaces; and conſequently, that in the great body of the earth there is much leſs of the groſſer æther, in proportion to the finer, than in the regions of the air: and that yet the groſſer æther in the air affects the upper regions of the earth, and the finer æther in the earth the lower regions of the air, in ſuch a manner, that from the top of the air to the ſurface of the earth, and again from the ſurface of the earth to the centre thereof, the æther is inſenſibly finer and finer. Imagine now any body ſuſpended in the air, or lying on the earth: and the æther being by the hypotheſis groſſer in the pores, which are in the upper parts of the body, than in thoſe which are in its lower parts, and that groſſer æther being leſs apt to be lodged in thoſe pores, than the finer æther below, it will endeavour to get out and give way to the finer æther below, which cannot be without the bodies deſcending to make room above for it to go out into.

EXTRACT *of ſome of the* QUERIES *of Sir* ISAAC NEWTON.

Qu. 18. IF in two large tall cylindrical veſſels of glaſs inverted, two little thermometers be ſuſpended ſo as not to touch the veſſels, and the air be drawn out of one of theſe veſſels, and theſe veſſels thus prepared be carried out of a cold place into a warm one; the thermometer *in vacuo* will grow warm as much, and almoſt as ſoon as the thermometer which is not *in vacuo*. And when the veſſels are carried back into the cold place, the thermometer *in vacuo* will grow cold almoſt as ſoon as the other thermometer. Is not the heat of the warm room convey'd through the *Vacuum* by the vibrations of a much ſubtiler medium than air, which after the air was drawn out remained in the *Vacuum?* And is not this medium the ſame with that medium by which light is refracted and reflected, and by whoſe vibrations light communicates heat to bodies, and is put into fits of eaſy reflexion and eaſy tranſmiſſion? And do not the vibrations of this medium in hot bodies contribute to the intenſeneſs and duration of their heat? And do not hot bodies communicate their heat to contiguous cold ones, by the vibrations of this medium propagated from them into the cold ones? And is not this medium exceedingly more rare and ſubtile than the air, and exceedingly more elaſtic and active? And doth it not readily pervade all bodies? And is it not (by its elaſtic force) expanded through all the Heavens?

Qu. 19. Doth not the refraction of light proceed from the different denſity of this æthereal medium in different places, the light receding always from the denſer parts of the medium? And is not the denſity thereof greater in free and open ſpaces void of air and other groſſer bodies, than within the pores of water, glaſs, cryſtal, gems, and other compact bodies? For when light paſſes through glaſs or cryſtal, and falling very obliquely upon the farther ſubſtance thereof is totally reflected, the total reflection ought to proceed rather from the denſity and vigour of the medium without and beyond the glaſs, than from the rarity and weakneſs thereof.

Qu. 20. Doth not this æthereal medium in paſſing out of water, glaſs, cryſtal, and other compact and denſe bodies into empty ſpaces, grow denſer and denſer by degrees, and by that means refract the rays of light not in a point, but by bending them gradually in curve lines? And doth not the gradual condenſation of this medium extend to ſome diſtance from the bodies,

dies, and thereby cauſe the inflexions of the rays of light, which paſs by the edges of denſe bodies, at ſome diſtance from the bodies.

Qu. 21. Is not this medium much rarer within the denſe bodies of the ſun, ſtars, planets and comets, than in the empty celeſtial ſpaces between them? And in paſſing from them to great diſtances, doth it not grow denſer and denſer perpetually, and thereby cauſe the gravity of thoſe great bodies towards one another, and of their parts towards the bodies; every body endeavouring to go from the denſer parts of the medium towards the rarer? For if this medium be rarer within the ſun's body than at its ſurface, and rarer there than at the hundredth part of an inch from its body, and rarer there than at the fiftieth part of an inch from its body, and rarer there than at the orb of *Saturn*; I ſee no reaſon why the increaſe of denſity ſhould ſtop any where, and not rather be continued through all diſtances from the ſun to *Saturn*, and beyond. And though this increaſe of denſity may at great diſtances be exceeding ſlow, yet, if the elaſtic force of this medium be exceeding great, it may ſuffice to impel bodies from the denſer parts of the medium towards the rarer, with all that power which we call gravity. And that the elaſtic force of this medium is exceeding great, may be gathered from the ſwiftneſs of its vibrations. Sounds move about 1140 *Engliſh* Feet in a ſecond minute of time, and in ſeven or eight minutes of time they move about one hundred *Engliſh* miles. Light moves from the ſun to us in about ſeven or eight minutes of time, which diſtance is about 70000000 *Engliſh* miles, ſuppoſing the horizontal parallax of the ſun to be about 12″. And the vibrations or pulſes of this medium, that they may cauſe the alternate fits of eaſy tranſmiſſion and eaſy reflexion, muſt be ſwifter than light, and by conſequence above 700000 times ſwifter than ſounds. And therefore the elaſtic force of this medium, in proportion to its denſity, muſt be above 700000 x 700000 (that is, above 490000000000) times greater than the elaſtic force of the air is in proportion to its denſity. For the velocities of the pulſes of elaſtic mediums are in a ſub-duplicate *ratio* of the elaſticities and the rarities of the mediums taken together.

If any one ſhould ſuppoſe that *æther* (like our air) may contain particles which endeavour to recede from one another (for I do not know what this *æther* is) and that its particles are exceedingly ſmaller than thoſe of air, or even than thoſe of light: The exceeding ſmallneſs of its particles may contribute to the greatneſs of the force by which thoſe particles may recede from one another, and thereby make that medium exceedingly more rare and elaſtic than air, and by conſequence exceedingly leſs able to reſiſt the motions of projectiles, and exceedingly more able to preſs upon groſs bodies, by endeavouring to expand itſelf.

Qu. 22. May not planets and comets, and all groſs bodies, perform their motions more freely, and with leſs reſiſtance in this ætherial medium than in any fluid, which fills all ſpace adequately without leaving any pores, and by conſequence is much denſer than quickſilver or gold? And may not its reſiſtance be ſo ſmall, as to be inconſiderable? For inſtance; if this *æther* (for ſo I will call it) ſhould be ſuppoſed 700000 times more elaſtic than our air, and above 700000 times more rare; its reſiſtance would be above 600000000 times leſs than that of water. And ſo ſmall a reſiſtance would ſcarce make any ſenſible alteration in the motions of the planets in ten thouſand years.

Qu. 23. Is not viſion perform'd chiefly by the vibrations of this medium, excited in the bottom of the eye by the rays of light, and propagated through the ſolid, pellucid, and uniform capillamenta of the optic nerves into the place of ſenſation? And is not hearing perform'd by the vibrations either of this or ſome other medium, excited in the auditory nerves by the tremors of the air, and propagated through the ſolid, pellucid, and uniform capillamenta of thoſe nerves into the place of ſenſation? And ſo of the other Senſes.

Qu. 24. Is not animal motion perform'd by the vibrations of this medium, excited in the brain by the power of the will, and propagated from thence through the ſolid, pellucid and uniform capillamenta of the nerves into to the muſcles, for contracting and dilating them? I ſuppoſe that the capillamenta of the nerves are each of them ſolid and uniform, that the vibrating motion of the ætherial medium may be propagated along them from one end to the other uniformly, and without interruption: For obſtructions in the nerves create palſies.

AS both this *æther* and the electric matter act by an elaſtic and repulſive power, it is neceſſary, that we ſhould mention what Sir *Iſaac Newton* ſaid in the Preface to his *Principia*, concerning a repulſive force, of certain particles of matter, which, he was of opinion, produced moſt of the phænomena in nature: His words are theſe; "* All the difficulty of philoſophy "ſeems to conſiſt in this, from the "phænomena of motions to inveſti-

---

[*] Omnis enim philoſophiæ difficultas, &c. vid. *Newt. Præf.* ad *Princip.*

“ gate the forces of nature, and then
“ from theſe forces to demonſtrate the
“ other phænomena; for, by propoſitions
“ mathematically demonſtrated,
“ we derive from the celeſtial phænomena
“ the forces of gravity, with
“ which bodies tend to the Sun and
“ the ſeveral Planets. Then from theſe
“ forces by other propoſitions alſo mathematical,
“ we deduce the motions
“ of the planets, the comets, the moon
“ and the ſea. I wiſh we could derive
“ the reſt of the phænomena of
“ nature, by the ſame kind of reaſoning
“ from mechanical principles; for
“ I am induced by many reaſons to
“ ſuſpect, that they may all depend
“ upon certain forces, by which the
“ particles of bodies, by ſome cauſes
“ hitherto unknown, are either mutually
“ *impelled* towards each other,
“ and cohere in regular figures; or
“ are *repelled* and recede from each
“ other: which forces being unknown,

" philoſophers have hitherto attempted " the ſearch of nature in vain." Again *, at the end of the *Principia*, Sir *Iſaac Newton* ſpeaks more fully concerning a moſt ſubtle matter, which, he ſays, pervades, and lies hid in all groſs bodies; by the force and action of which ſpirit, the particles of bodies mutually attract one another at ſmall diſtances, and cohere when in contact, and electric bodies operate at greater diſtances, as well by repelling as attracting the neighbouring corpuſcles, and light is emitted, reflected, refracted, inflected, and heats bodies, and all ſenſation is excited, and the members of animal bodies move at the command of the will, namely, by the vibrations of this ſpirit mutually propagated along the ſolid filaments of the nerves, from the outward organs of ſenſe to the brain, and from the brain into the muſcles: but, ſays he, theſe are things that cannot be explained in few words, nor are we furniſhed with that ſufficiency of experiments, which is required to an accurate determination and demonſtration of the laws, by which this *electric* and *elaſtic* ſpirit operates.

---

* Adjicere jam liceret nonnulla de ſpiritu quodam, &c. vid. *Newt. Princip.* ad calcem.

To MARTIN FOLKES, *Eſq;*
PRESIDENT *of the* ROYAL-SOCIETY.

SIR,

Read *Nov.* 13. 1746.

HAving more maturely conſidered the twelfth propoſition contained in the papers I delivered to you, and having made ſeveral experiments, as well as carefully peruſed Dr. *Robinſon*'s treatiſe on the *æther* (from which I gained a much clearer conception of the nature and laws of that ſubtle fluid, than I ever had before) I find, upon a farther inquiry into the nature of the electric matter and that of the *æther*, and comparing them together, that they have a great affinity, as far as can be judged from reaſon and experiments, if they are not one and the ſame thing: and ſhould it be objected, that the electric matter iſſuing from bodies is luminous and ſulphureous, we anſwer, that by the vibrations of the *æther*, or electric matter (cauſed by friction) the looſe particles of light, and ſulphur, or other ſubtle matter lodged within the pores of bodies, are indeed thrown off, or emitted along with that ſubtle matter which I have called the electric matter; but yet are not any eſſential part of the *æther* or *electric matter:* and this was the opinion of the Doctor when I was with him in *Dublin*.

That very learned and ingenious Gentleman, in the Preface to his Diſſertation, ſays, " that he has explain-
" ed thoſe properties of the *æther*,
" which Sir *Iſaac Newton* has deli-
" vered in his Optics. That the *æther*
" being a very general and material
" cauſe, without any objection appear-
" ing againſt it from the phænomena,
" no doubt can be made of its exiſ-
" tence: for by how much the more

" general any cauſe is, by ſo much " the ſtronger is the reaſon for allowing its exiſtence. That the *æther* is a much more general cauſe " than our air: and on that account, " the evidence from the phænomena, " is much ſtronger in favour of the " exiſtence of the *æther*, than it is in " favour of the exiſtence of the air."

As the *æther* ſeems to be the ſole cauſe of the electrical phænomena, and as few in this kingdom have got that treatiſe, it will not be improper to mention the firſt, fourth, and fifth Propoſitions. By the firſt, the Doctor explains the nature of an elaſtic fluid (which, I believe, the electric matter is allowed to be) and by the fourth and fifth, the manner, in which the *æther* cauſes an univerſal attraction and gravitation; theſe will ſuffice to illuſtrate the nature of the *æther*, ſo far as it regards my preſent purpoſe: as for the demonſtrations and further properties of it, I refer to the Book itſelf.

PROPOSITION I.

" If a fluid be compoſed of exceedingly ſmall particles of matter, placed
" at very ſmall and equal diſtances
" from one another; if all the particles of one and the ſame fluid, have
" equal diameters and denſities, and
" be all endued with centrifugal forces, by which they endeavour to
" recede from each other; if this force
" in the particles do not extend beyond, but terminate in the particles lying next to them; and if the
" centrifugal force of two particles, or
" the force with which they endeavour to recede from each other, be
" as their denſity directly, and as their
" diameter and the diſtance of their
" centers taken together inverſly;
" the elaſtic force of the fluid will be
" directly as the denſity of the particles,

“ cles, and inverſly as their diameter
“ and the cube of the diſtance of
“ their centers taken together; and
“ that the ſame force will likewiſe be
“ as the denſity of the fluid directly,
“ and as the fourth power of their diameter
“ inverſly.”

PROPOSITION IV.

“ If a ſubtle *æther*, be expanded
“ through the univerſe, and be ſuppoſed
“ at firſt to be of the ſame
“ denſity every where; and if every
“ body, and the *æther* lying next to
“ it on all ſides, endeavour to recede
“ from each other with a force, which
“ is as the quantity of matter in the body,
“ and the denſity of the ſurrounding
“ *æther*, taken together; I ſay that
“ the *æther*, by virtue of this power
“ which I ſhall call a repulſive power,
“ will loſe its uniform denſity, and
“ become denſer and denſer in receding
“ from the body; and that the

" increment of its denſity at any diſ-
" tance from the center of gravity of
" the body, will be as the quantity
" of matter in the body directly, and
" as the ſquare of that diſtance in-
" verſly."

The *æther*, according to the Doctor's firſt Corollary to his fourth Propoſition, is rarer in bodies than in empty ſpaces without them, and rarer in ſmaller empty ſpaces than in larger, and of conſequence, rarer in denſe bodies than in rare bodies; becauſe denſe bodies have leſs empty ſpace within them in proportion to their magnitudes, than bodies which are rarer.

PROPOSITION. V.

" If a ſubtle *æther* and bodies, act
" on one another in the manner ſup-
" poſed in the laſt propoſition; the
" effect of this action will be an uni-
" verſal attraction, or a mutual ten-
" dency of all bodies towards one

" another: and any two bodies will " tend or gravitate towards each other " with a force or weight, which is as " the quantity of matter of the two " bodies taken together directly, and " as the ſquare of the diſtance of their " centers of gravity inverſly."

If the *æther*, or electric matter, can be accumulated into any particular body, in a greater quantity, than is common to the denſity of that body, the elaſtic force will be encreaſed; conſequently that quantity of accumulated electric matter, or *æther*, will recede from the denſer part of the *æther*, towards the rarer; ſo that when any body which is denſer than air, is placed within the ſphere of the elaſtic *æther*, or electric matter, by the ſame principle it will paſs into ſuch body, where the *æther* is rarer.

When two bodies move towards one another, the *æther* is denſer without the bodies, than it is between them.

For if a feather, or ball of cork, or other light body be electrified, and ſuſpended with a thread, the electric atmoſphere may be conſidered, as equally preſſed by the *æther* ſurrounding it, and therefore in a ſtate of reſt, if there be nothing near it, but the body by which it is ſuſpended; but upon coming near the electrified ball or feather, with a body that is not electrified, or in which, there is no accumulated matter, but what it has originally, according to its denſity, and if that body be more denſe than air, the *æther* in it, will be rarer than that in the air; the *æther* then is denſer without, or between the electrified body, and the denſer *æther* in the air, than between the electrified body, and the rarer *æther* in the body, that is denſer than air; and the denſer the body, the leſs will be the reſiſtance of this elaſtic *æther*, as we have ſaid before. Therefore, as the reſiſtance is leſs between

tween the electrified body, and the non-electrified body, than between the electrified body, and the air, it follows, from the foregoing properties of the *æther*, that they will tend towards each other.

When two bodies move from one another, the *æther* is denſer between the bodies, than it is without them: this is alſo manifeſt, from the experiment of the feather; for if two feathers, or other light bodies, whoſe weights are leſs than the accumulated elaſtic force, be electrified, they will recede from each other with forces in proportion to the denſity of the accumulated *æther*. That this may be rendered more clear, let us ſuppoſe A and B (in fig. 7.) to be two non-electric globes of equal diameters and denſities, which are ſuſpended with ſilk or thread, and afterwards electrified; now ſince the accumulation in A or B when electrified, is acquired by certain pulſes or vibrations of the *æther* communicated to B or A from other bodies in motion, thoſe pulſes or vibrations will be propagated from A or B, to D, the air and *æther* ſurrounding thoſe bodies, and their vibrations propagated from any point near the ſurface of B or A, to ſtill greater diſtances, forming a kind of atmoſphere round A or B, till thoſe pulſes become weak, inſenſible and vaniſh; it follows then, that the denſity of the electric matter or *æther* accumulated in A or B, is greater at the ſurface of B or A, than it is at a greater diſtance from the ſurface of thoſe bodies. And therefore the reſiſtance is leſs where the *æther* is rareſt, or where the pulſes or vibrations terminate: for when the *æther* within a body is put into a vibrating motion, that motion in receding from the body, grows weaker, as the ſquare of the diſtance increaſes. The ſpace then, or ſurrounding atmoſphere, from the ſurface of either body B or A, to where thoſe vibrations vaniſh, we will denote with D: and the *æther* that ſurrounds the atmoſphere of accumulated electric matter, or *æther* repreſented by D, we will expreſs with *R*; for we ſuppoſe the *æther* there, to be void of thoſe pulſes or vibrations, and therefore coincide with the atmoſphere D, where its vibrations terminate: it is clear then, that the *æther* is denſer where it is in a vibrating motion, as in D, then where it is not ſo as in *R*. I ſay then, that the acting force of the *æther* is greater between A D D B, than between B D *R*, or A D *R*; therefore if the bodies A and B are lighter than the acting, or reſiſting force D D, between them, they muſt recede from each other.

PROPOSITION I.

If all bodies have electric matter or *æther* within them in a certain proportion (as we before have endeavoured to demonſtrate) non-electric bodies muſt repel bodies that are electrified, in like manner as electrified bodies repel each other: but the reſiſtance from non-electric bodies, is inconſiderable and weak, to that of bodies when they are electrified: for the vibrations and elaſtic force of this *æther*, is always as its denſity in different bodies.

Proof by EXPERIMENT.

Take two plates of any non-electric matter, ſuch as copper, tin, or braſs; let their ſurface be very near equal, and made clean and dry; hang one of them to any electrified non-electric; then let there be placed a thin light body upon the non-electrified plain, ſuch as leaf-gold, ſilver, or braſs; and hold that plane under the other at a proper diſtance, which will ſoon be found in making the experiment; for the light body will be ſuſpended between them, but neareſt the plane where there is the leaſt reſiſtance, which, by the foregoing principles, is the non-electric not electrified: but this ſuſpenſion depends upon the flux or accumulated electric matter or *æther* being always equal, and the non-electric plate continually kept ſo, during the experiment, by letting it be contiguous to other non-electics.

COROLLARY.

Hence, if the accumulated electric matter or *æther* by the pulſes or vibrations in a body electrified, did not excite and ſtir up a vibrating motion of the *æther* in the non-electric body on that ſide neareſt the electrified body, by the vibrations and elaſtic force of which they muſt repel each other, the light body between them could not be ſuſpended: but, on the contrary, according to the common received opinion, would riſe and fall alternately, whilſt any of the accumulated matter remained in the body electrified: for, by the repeated attractions and repulſions, the electric matter ſhould waſte and diſſipate into the non-electric, or the earth.

PROPOSITION II.

When a non-electric body is electrified, the accumulated matter will cauſe a light body, which is placed within the ſphere of its vibrations, to approach it, and that by an elaſtic, or repulſive force; which is the property of the *æther* given in the propoſitions before quoted.

Let A (in fig. 3.) denote the earth, B, any light body placed upon the ſame, and ſuppoſe C another body ſuſpended with ſilk, to have received a greater quantity of the electric matter or *æther*, than it had originally; then (by the Doctor's Corollary) if the electric matter or *æther* paſſes into the denſeſt bodies with greater eaſe than it does into rarer, on account of the *æther* being rarer in denſe bodies, than it is in thoſe bodies which are rarer; the light body B will receive a quantity of the electric matter, or *æther* from C, more than B had originally in its natural ſtate, which quantity muſt increaſe the elaſtic force of B, and in proportion only to the quantity it receives from C; B then being ſo encreaſed, will recede from A, in proportion to the encreaſe of its elaſtic force, and the excited or communicated vibrating motion of A, cauſed by the ſmall vibrating motion of B, at that inſtant (by Corollary to Propoſition I.) And if there be a continual flux of this electric matter or *æther*, from C to B, and from B to

A, in every inſtant and near approach of B to C, from the time of its firſt riſing, B will continually receive an encreaſe of the electric matter or *æther* from C, and the *æther* in and near the ſurface of A, will continually be encreaſed in denſity, by the vibrations thereof growing every moment ſomething ſtronger, as the other increaſes its accumulated matter or *æther*, by approaching nearer and nearer to C. But the vibrating force in A, cannot increaſe equally as the vibrating force in B increaſes, on account of its greater magnitude; for we ſuppoſe the non-electric body to be the floor or the earth; ſo that when B becomes equally replete with electric matter or *æther* as C, the vibrating motion of A, is ſmall and inconſiderable to B or C, and therefore becauſe the acting force or vibrations are equal in B and C, and are ſtronger than in B and A, they will recede from each other, for the reaſon we have given before: and the force by which they recede will be greater, than when B receded from A: becauſe the quantities of electric matter or *æther* are different, at different diſtances, whence the force muſt differ as the quantity of matter accumulated. Again, let C be taken away; and ſuppoſe B to be electrified and in the air, for the ſame reaſon we have mentioned before, that the *æther* is denſer in air than it is in denſer bodies, the electric matter or *æther* in B, will endeavour to diſſipate or paſs where there is the leaſt reſiſtance; therefore when a denſer body than air is near the electrified body B, the exceſs of accumulated electric matter or *æther* which is in B, will paſs into it; for the reſiſtance on that ſide of the body B, which is fartheſt from the denſe body, is greater than between B and the other body; on account of the *æther* being denſer without the bodies, than it is between them, as we have mentioned before. And this is the caſe when a piece of down, or light feather, is replete with electric matter or *æther*, and in the air, that the ſame will either be impelled to the floor, or the ceiling of the room, or to what other denſe body that happens to be neareſt, by the acting force of the denſer *æther* without it.

PROPOSITION III.

When two non-electric bodies B and C (as in fig. 4.) have received an exceſs of electric matter or *æther*, and there is a continual flux communicated to one of the bodies C, which conveys it to the other body B, ſo faſt as the exceſs flows out into the air, or other adjacent bodies, the body B will recede from C, the greater force, and be repelled from A, which is a non-electric, and placed at four or five inches diſtance from C; (by Propoſition I.) B

then

then being acted upon with oppoſite forces, will be ſuſpended, ſo as to touch nothing viſibly. And this ſuſpenſion will be continual, ſo long as the flux of electric matter or *æther* is continued equal: but B, the ſuſpended body, will be always neareſt the non-electrified body, whether the bodies (which are to be planes) be placed horizontally, and afterwards inverted, or placed vertical; and the diſtance of B will be greater or leſs from A the non-electric, as the quantity of non-electric denſe bodies contiguous to A is greater or leſs.

For if C and B receive an accumulation of electric matter, or *æther*, by which is cauſed a vibrating motion of the *æther* greater or leſs, round C and B, to certain diſtances, in proportion to the accumulated matter in each body; and if that increaſe be equal in C and B, it is clear, that the reſiſting force is greater at any aſſigned diſtance between C and B, than it is at the ſame or an equal diſtance between B and A, from what has been ſaid before; for the electric matter or *æther* in A, will not be increaſed, ſo as to have an accumulation equal to B or C, (if A, the non-electric be placed upon non-electric bodies) but only a weak vibrating motion, cauſed by the vibrating motion of the *æther* or electric matter iſſuing from B: (by Corollary to Propoſition I. and Propoſition II.) therefore the elaſtic force from A to B, is not equal to that from B to A, or from B to C, or C to B; but the forces from C to B, and B to C, and from B to A, are equal, by the bodies C and B being equally electrified; ſo that if the body B is ſuſpended, B muſt approach ſo near the non-electric plane A, 'till the iſſuing and acting elaſtic force from B and A coincide with the acting force from B to C, and from C to B.

As to the ſecond part of this Propoſition, that the diſtance of B from A the non-electric body, varies more or leſs, as the quantity of non-electric denſe bodies contiguous to A, is greater or leſs, we prove from the following experiments.

Firſt EXPERIMENT.

Place the plane A upon a body electric *per ſe*, and lay the leaf-gold upon it, and let the upper plane C be hung directly over it, at the ſame diſtance we did before; then let a wire paſs to the lower plane A, from the upper plane C, or from the rod, (which wire is to communicate the electric matter or *æther* to A, at the ſame time it does to the plane C) and electrify the planes; the body B, which was laid upon A, before A and C were electrified, will continue at reſt, without moving the leaſt.

Second EXPERIMENT.

Again, let the wire be taken away from A, and the body B will be ſuſpended,

pended, but very near A, and will riſe up and down ſeveral times during the experiment, occaſioned by the inequality of the pulſes in A.

Third EXPERIMENT.

But if with a piece of wire you touch the plane A, in the firſt or ſecond experiment, or with your hand, or other non-electric body, the plane A thereby becoming a greater non-electric, will cauſe the body B to approach nearer towards C the electrified body: where it will hang at right angles with the planes, and *in æquilibrio.*

In theſe experiments, there is a kind of gradation in the ſuſpenſion of a light body between two other bodies; a little further conſideration of which, may lead us to a clearer conception how this elaſtic fluid operates. For we ſee, that as the reſiſting force increaſes from the non-electric plane A, till it becomes equally electrified with C, the acting force from B and C decreaſes, till the ſuſpenſion ceaſes.

COROLLARY.

Therefore the two oppoſite forces, if they are equal, they deſtroy each other: conſequently B muſt remain at reſt, as is manifeſt from the firſt experiment.

Hence when the reſiſtance is leaſt from the non-electric body, the diſtance of B from the non-electric, will be greateſt: and therefore we find denſe bodies always beſt to make the experiment with, becauſe the *æther* in them being moſt rare, is with greater eaſe put into a vibrating motion, in that plane which is the non electric, the vibrations of which will extend only to a very ſmall diſtance from the ſurface, and conſequently cannot deſtroy (by any ſtrong re-action) the force of the vibrating motion of the *æther* from the body B, as the vibrations of the *æther* from the two planes when equally electrified appear to deſtroy each other.

For the *æther* between the two planes C and A, in this caſe, muſt be conſidered as uniformly denſe by the action of equal and oppoſite forces of the vibrating electric matter or *æther*; therefore B, which is ſuppoſed to be placed between them, and equally replete with electric matter or *æther*, muſt be acted or preſt upon equally by the uniform denſity of the vibrating *æther* between the planes ſurrounding it: ſo that B reſts upon that plane which is neareſt the center of the earth, for the ſame reaſon it would do, if the planes were not electrified.

To illuſtrate this ſtill further, with other experiments, tho' much of the ſame nature with the former; take the two planes C and A, and place them vertical to the horizon, and put betwixt A and C as much thiſtle-down as will lay between them without falling, then electrify both the planes:

the down will be electrified alſo, but will not be ſeen to ſtretch out its fibres any where but in thoſe parts that lie on the outſide, and neareſt any non-electric, where there is the leaſt reſiſtance, and where the electric matter or *æther* endeavours to diſſipate; and therefore the elaſtic force of the *æther* cauſes it to extend itſelf, and endeavour to recede from the denſer *æther*, between the planes, towards the rarer, in the non-electric body. Whereas, on the other hand, the down that is moſt between the planes, (where the electric matter or *æther* is denſer and equally reſiſted) will appear weak and lax, as if not electrified. That this down between the planes is really in the ſtate we have mentioned, appears more evident, by a non-electric approaching towards either plane, ſo as to cauſe a ſnap: when at that inſtant, a manifeſt difference will be ſeen between the down that is moſt remote, or on the outſide, and that which lies more in the middle; for the extended down on the outſide, will immediately drop, and ſeem to looſe its accumulated matter for that inſtant; whereas, the other down lying more within the planes, will not move in the leaſt.

Again, if one of the planes be electrified only, (the other plane continuing upon the body electric *per ſe)* the down between them will ſtretch a little; and upon making the non-electric body, placed upon the body electric *per ſe*, perfectly non-electric, by laying hold of the plane with a body non-electric, the down between them will ſtretch out very ſtrongly towards the electrified body. Now, if the flux of electric matter or *æther*, out of the earth, was equal to the flux from the electrified body (as hath been ſuppoſed to have been the cauſe of the ſuſpenſion) it would be impoſſible from a force of that nature, acting in oppoſition to an equal force from the electrified body, to ſuſpend B: becauſe, we ſee, that when two ſuch forces act, which is the ſame thing as when the two planes are electrified equally, the body B will not move in the leaſt. But if the acting force of one of the planes is leſſened, for example A, the body B will move a little, and ſo in proportion will the body move, as the quantity of electric matter or *æther* decreaſes in that plane. And therefore when there is no accumulation of electric matter, or *æther* in A, but what is cauſed by the vibrating motion of B, communicated from C, and when that plane is placed upon a large quantity of non-electric matter, that body B will be ſuſpended at the greateſt diſtance from A, as we have ſaid before.

It appears from the principles we have advanced, that the electric matter or *æther* (if it be condenſed, or compreſs'd on one ſide more than another) will paſs into bodies that are denſeſt, where there is the leaſt compreſſure or reſiſtance.

Hence we find, that the ſucceſſive riſing of the water on the moiſtened globe, when made to revolve on an axis, in the experiment to the twelfth Propoſition of the firſt paper, is occaſioned by this reſiſting or repulſive force.

Hence alſo, if inſtead of one globe, there be two, and of the ſame nature, and each dipt into water, one of them afterwards electrified, and both made to revolve on ſeparate axis (which two globes may repreſent *celeſtial bodies)* the fluid on the ſurface of each, will riſe ſucceſſively towards one another, as they continually move round; and the riſing thereof on each globe, will be in proportion to the denſity of that fluid ſurrounding both bodies.

It is from the ſame principle, namely, a repulſive power, that the *momentum* of a fluid paſſing through a ſiphon, is increaſed by accumulating the electric matter, or *æther*, in the veſſel where the ſiphon is immerged, and holding a non-electric near it; or by bringing the ſiphon not electrified near any body electrified.

Dr. *Robinſon* has ſhewn in a more particular manner, in the treatiſe I have mentioned, how this *æther* cauſes an univerſal attraction and gravity; beſides the principal phænomena of light, namely, its emiſſion, refraction, reflection, inflection, and fits of eaſy tranſmiſſion and eaſy reflection, and the rarefaction of bodies by heat; and alſo how it cauſes elaſticity, muſcular motion, ſenſation, coheſion, and fermentation.

If the electric matter is admitted to be the *æther*, my former papers will require very little alteration (if any) to render them equally agreeable to theſe my preſent ſentiments; and I muſt confeſs, ſo far as I can judge from the phænomena of electricity, and the properties of the *æther*, that all the experiments I have hitherto to ſeen or heard of, do not in the leaſt contradict this doctrine, but rather help to confirm and ſtrengthen it.

This, Sir, is the reſult of my enquiries: how far I have ſucceeded in them, I leave to the favourable determination of thoſe gentlemen, whoſe abilities and leiſure enable them to make deeper reſearches into the nature and properties of this *electric matter*, or *æther*. If there be any thing that I have advanced, that may be an uſeful hint to others, it will give me ſufficient ſatisfaction, that I have been any ways inſtrumental in promoting that part of experimental philoſophy which at this time in particular, is ſo eagerly ſought after. *I am,*

with the deepeſt ſenſe of Your favours,

your moſt obliged,

And obedient ſervant,

BENJAMIN WILSON.

To MARTIN FOLKES, *Eſq*;
PRESIDENT *of the* ROYAL-SOCIETY.

SIR, *London*, *Nov.* 14. 1746.

Read *Nov.* 20. 1746.

I Beg leave once more to trouble you with an account of another very remarkable experiment in electricity I have lately tried.

About ten days ago, Mr. *Watſon* ſhewed me an experiment at his houſe, I had never before ſeen or heard of. It was performed with a vial filled with water, and covered on the outſide with lead; (which is the ſame as immerging the bottle in water after my own method, to increaſe the ſhock) to the bottom of the vial, in the lead, was made faſt one of the ends of a long ſmall wire; the other end was twiſted round a poker, or bar of iron. This poker he held in his hand, ſo that

he

he was able to touch a gun-barrel that was ſuſpended with ſilk and electrified. This gun-barrel electrified the vial by means of another wire paſſing from the gun-barrel into the vial covered with lead. Upon his approaching the gun-barrel electrified with the end of the poker, moſt remote from the vial, there iſſued a large flame and ſnap; but he could perceive no ſenſation in his hand. I then tried the experiment myſelf, by taking hold of the ſame poker, and approaching the gun-barrel as he had done before, when there iſſued a flame and ſnap equal to the former, and, I thought, a very ſmall ſenſation in that hand which held the poker.

However, after I had ſeen the experiment, I was ſomewhat ſurprized: but upon conſidering it at home, I found that if my former conjectures were right, the cauſe of this, then ſtrange, phænomenon, muſt proceed from the ſame principle I had advanced: therefore the next morning I waited upon Mr. *Watſon*, and deſired he would try the ſame experiment he had made the morning before, but with a *rarer* body than iron; and for this reaſon, becauſe iron being more denſe than the perſon's hand who touched the poker, the electric matter, according to the properties of the *æther*, would paſs more freely, where there was the leaſt reſiſtance, which is always leaſt in the denſeſt bodies; and therefore if a rarer body than iron, or the hand was held by a perſon inſtead of the poker, there ought to be a very ſtrong ſenſation in the hand of ſuch perſon. We accordingly tried it, and made uſe of a pack-thread dipt in water: the effect we found to be a ſmart ſenſation. On *Thurſday* the thirteenth of *November*, Mr. *Watſon* mentioned at the Royal Society, that he had ſince then tried the experiment ſeveral times, but did not ſucceed as we had done before. I then deſired we might try it again the next day, which we did accordingly in the evening between four and five o'clock, and had the ſame (or rather greater) effect, than we received the week before. This experiment we tried different ways, particularly with the denſe and rare bodies at the ſame time; for each of us, at different times, held in one hand the poker, to which was tied a wet pack-thread, and faſtened the other end of the thread to the wire, that paſt to the bottle, which pack-thread was held in the other hand; then upon touching, or coming near the gun-barrel electrified with the poker, there iſſued a large flame and ſnap; but the ſenſation was very weak in the hand that held the poker, whereas the other hand was very much *convulſed*. But if the hand that held the poker was removed, and one hand only held the thread; upon touching the gun-barrel with the thread or poker, that hand would not be convulſed; yet there would be a ſmart ſenſation, as in the firſt experiment. And as to its being ſtronger when both hands take hold, it is for the ſame reaſon, that in the common experiment with the vial, a man always feels a ſtronger effect when he touches the vial with one hand, and the electrified body with the other, than when he approaches the electrified body only; the re-action of the elaſtic matter, or *æther*, being reſiſted in oppoſite directions, by ſuch communication. But all the elaſtic particles are not acted upon at the ſame inſtant, yet ſo near, that the difference of time cannot be accurately aſcertained.

This experiment will ſtrengthen and corroborate the propoſitions I have mentioned, and help to demonſtrate the electric matter and the *æther* to be univerſally the ſame thing: and as ſuch I thought the account would be acceptable from,

SIR,

Your moſt obliged,

And obedient humble ſervant,

B. WILSON.

POSTSCRIPT.

AS the experiment of the vial performed by profeſſor *Muſchenbroek*, is very extraordinary, and ſince we have endeavoured to account for the moſt material phænomena of electricity, from the properties of the *æther*, and improved his experiment, by encreaſing the ſhock to any degree; it may be expected, that ſomething further, than what we have already mentioned, ſhould be ſaid concerning the cauſe of its ſtrange effects: but as the experiments of this kind admit of ſuch variety, it would be endleſs to diſcuſs them all; and therefore, I have choſen only to conſider the manner of its acting in general.

If we admit, that the *æther* is in all bodies, and in the proportion before-mentioned, it will be eaſy to ſhew, why the ſhock from the vial is in proportion to the points *in contact* of a *non-electric* on the outſide of the vial, as when it is immerged in water, or covered with lead, or quickſilver, or any other *non-electric* body, and the water within the vial electrified by a wire paſſing into the ſame, which is to communicate with a rod of iron properly ſuſpended and electrified: for by this method, the increaſe may be carried on to any degree, by uſing larger glaſſes: but there are ſome other circumſtances to be regarded, in order to ſucceed in this experiment, which are theſe. The air muſt be dry. The neck of the vial four inches at leaſt clear from the water without, which muſt likewiſe be kept very dry, and clean from duſt: otherwiſe the electric matter, or *æther*, will be conducted to the water without, and ſo diſſipate. And the vial muſt be of the thinneſt glaſs: becauſe the vibrations of the *æther* are leſs obſtructed by a body *elec-*

tric per ſe, which is thin, than when it is thicker, as we have ſhewn before; conſequently the pulſes of the accumulated *æther* within the glaſs in the water, will reſiſt more ſtrongly, or act with a greater force againſt the *æther* without the glaſs; and ſo paſs with greater eaſe into the contiguous non-electric denſe body ſurrounding it, in which there is the leaſt reſiſtance. And therefore, when any number of particles of the accumulated matter, or *æther*, are ſuddenly or inſtantaneouſly reſiſted in any part of the electrified bodies; as for example, the wire; thoſe particles of the electric matter, or accumulated *æther* in it, will be propagated by ſuch reſiſtance, to the next accumulated particles of *æther*, nearly contiguous in that body (by Lemma. to Propoſition VII. in the firſt paper) and from thence to the next, and ſo on the water within to the vial or glaſs, where the *æther* is accumulated alſo; the particles of which acting from every part of the ſurface, will be reſiſted likewiſe, and that accumulation will be forced by ſuch reſiſtance through the thin glaſs into the non-electric body where there is the leaſt reſiſtance.

That a ſudden reſiſtance can be cauſed, appears from the flame and and ſnap, we ſee and hear, which firſt cauſes a rarefaction, by leſſening the divergency of the iſſuing electric matter or *æther*, and that rarefaction a ſudden *vacuum* in the air, as we have mentioned before. This rarefaction and *vacuum*, though it appears very ſmall, yet it is exceedingly great with reſpect to the exceeding ſmallneſs of the particles, which compoſe this elaſtic fluid or *æther:* and the reſiſtance ariſing from ſuch a *vacuum*, is ſufficient to produce any effect of this kind whatſoever. And as action and re-action are always equal, the electric and non-electric will be reſiſted ed equally. Hence it comes to paſs, that when a man which is electrified approaches another that is not ſo, the reſiſtance or ſenſation in each, is always found to be equal.

This increaſe of reſiſtance may be further obvious by the following calculation, wherein the difference of the number of particles of *æther* acting on the ſurface of two glaſs veſſels of different diameters, is made to appear. In order to which, we have ſuppoſed a given number of ſuch particles of *æther* to be acting in a ſquare inch on the ſuperficies of the glaſs: tho' the real number of particles may be infinitely greater, yet it will ſerve to form a much clearer conception how the effect does increaſe by taking larger vials, and increaſing the points in contact, in the ſame proportion.

The area of the ſurface of a globe four inches diameter, is nearly fifty ſquare inches. Now, if on the ſurface of each ſquare inch, there be ſuppoſed 10000 particles of *æther*, the number of particles acting upon the whole ſurface will be 50 × 10000 = 500000.

By the ſame method, the area of a globe 32 inches diameter, will be found nearly 3217; and if there be acting likewiſe an equal number of particles of the *æther*, on the ſurface of this in a ſquare inch, namely 10000, the number of particles acting upon the whole, will be 3217 × 10,000 = 32,170,000. The difference then between the firſt and this, is 31,670,000, therefore the reſiſting force of the *æther* from the globe of 32 inches diameter, would be near 64 times greater than the reſiſting force of the *æther* from the globe of four inches diameter.

And this would be the difference, in the effect, could the accumulated *æther* of the whole reſiſting force, of every moving elaſtic particle acting through the glaſs upon the *æther* in contact, on the outſide, be received into the hand, or other ſenſible part, from whence this reſiſtance is propagated (as Sir *Iſaac Newton* expreſſes it) along the ſolid, pellucid and uniform capillamenta of the nerves into the place of ſenſation. And further if all the particles in any electrified dody, can be received, or propagated into any particular denſe body, the force will be greater or leſs in ſuch particular body, as the ſurface of thoſe bodies in contact are greater or leſs. For if one, two, three, or more perſons ſtanding on electric bodies, receive an accumulation of the *æther* equally by touching one another, the firſt perſon's hand graſping that of the ſecond, and the other hand of the ſecond touching the hand of the third, with his finger only; and then if a non-electric touch the hand of the third perſon, the finger of the ſecond touching the third, will feel a ſenſation, but his other hand which graſps the firſt, will feel nothing. Again, if the ſecond graſps the third, and touches the hand of the firſt with his finger, as he did the third before, the ſenſation then will be in the finger of the ſecond, touching the hand of the firſt; and nothing will be felt in the other hand which graſps the third. Hence it is manifeſt, that the particles of *æther* in motion are contracted, or their divergency leſſened, by paſſing through ſmall denſe ſolids, than through larger, where, by the elaſtic force of the particles, they ſpread to a greater diſtance from each other; and therefore ſmall rods of iron are the moſt proper to take hold of, in trying the above experiment. And as the *æther* is found to paſs with the leaſt reſiſtance through denſe bodies; every one who tries the experiment with the vial, ſhould take hold of one end of a bar, or rod of iron, and put the other into the water, cloſe to, and near the bottom of the glaſs immerged therein; for by this means, more of the reſiſting particles of *æther* are collected, and therefore greater will be the effect.

FINIS.

E R R A T A.

Pag.	*line*	*for*	*read*
11	4	in a another	in another
16	18	they become	it becomes
27	14	the other	the other not,
28	7	opperations	operations
57	23	the æther	the *æther* or electric matter
59	8	the æther	the *æther* or electric matter
68	5	that	for

BOOKS Printed for C. DAVIS *againſt* Grays-Inn, *in* Holbourn.

EXperiments and Obſervations tending to illuſtrate the Nature and Properties of Electricity. The 3d Edition. By W. WATSON, F. R. S. Price 1 s.

A Sequel to the Experiments and Obſervations tending to illuſtrate the Nature and Properties of Electricity; wherein it is preſumed, by a Series of Experiments expreſly for that Purpoſe, that the Source of the Electrical Power and its manner of Acting are demonſtrated. Addreſs'd to the Royal Society. By W. WATSON, F. R. S. Price 1 s. 6 d.

A Letter from Paris, concerning ſome new Electrical Experiments made there by Monſ. Monier. Price 6 d.